

## Algebra 2 CC: Laws of Exponents

When multiplying or dividing algebraic terms, we use the rules for exponents when the terms involve powers of a variable. For example:

$$a^3b^2(3a^2b) = 3a^5b^3$$

$$x^4y^5 \div x^3y^2 = xy^3$$

$$(c^3d^2)^2 = c^6d^4$$

These examples illustrate the following rules for exponents. If  $a$  and  $b$  are positive integers, then:

*Multiplication:*  $x^a \cdot x^b = x^{a+b}$

*Division:*  $x^a \div x^b = x^{a-b}$  or  $\frac{x^a}{x^b} = x^{a-b} \quad (x \neq 0)$

*Raising to a Power:*  $(x^a)^b = x^{ab}$

*Power of a Product:*  $(xy)^a = x^a \cdot y^a$

*Power of a Quotient:*  $\left(\frac{x}{y}\right)^a = \frac{x^a}{y^a}$

## Developing Skills

In 3–26, simplify each expression. In each exercise, all variables are positive.

3.  $x^3 \cdot x^4$

4.  $y \cdot y^5$

5.  $x^6 \div x^2$

6.  $y^4 \div y$

7.  $(x^5)^2$

8.  $(2y^4)^3$

9.  $10^2 \cdot 10^4$

10.  $-2^6 \cdot 2^2$

11.  $x^4 \cdot x^2y^3$

12.  $xy^5 \cdot xy^2$

13.  $-(3x^3)^2$

14.  $(-3x^3)^2$

15.  $x^8y^6 \div (x^3y^5)$

16.  $x^9y^7 \div (x^8y^7)$

17.  $(x^2y^3)^3 \cdot (x^2y)$

18.  $(-2x)^4 \cdot (2x^3)^2$

19.  $\frac{(4x)^3}{4x^3}$

20.  $\frac{3(x^3)^4y^5}{3x^7}$

21.  $\frac{-x^4y^6}{(-x^3y^4)}$

22.  $\left(\frac{x^3y^5}{(xy^2)^2}\right)^2$

23.  $\frac{x^2(y^3z)^3}{(x^2y)^2z}$

24.  $\left(\frac{2a^3}{a^2}\right)^5 \cdot b$

25.  $\frac{4(ab)^2c^5}{abc}$

26.  $\frac{(a^x)^yb}{a^{xy}}$

## Applying Skills

27. What is the value of  $n$  if  $8^3 = 2^n$ ?

28. What is the value of  $a$  if  $27^2 = 9^a$ ?

29. If  $3^{a+1} = x$  and  $3^a = y$ , express  $y$  in terms of  $x$ .

30. If  $25^{b+1} = x$  and  $5^b = y$ , express  $x$  in terms of  $y$ .